

RV-YOLOX: Object Detection on Inland Waterways Based on Optimized YOLOX Through Fusion of Vision and 3+1D Millimeter Wave Radar

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Abstract : Unmanned Surface Vehicles (USVs) are valuable due to their ability to perform dangerous and time-consuming tasks on the water. Object detection tasks are significant in these applications. However, inherent challenges, such as the complex distribution of obstacles, reflections from shore structures, water surface fog, etc., hinder the performance of object detection of USVs. To address these problems, this paper provides a fusion method for USVs to effectively detect objects in the inland surface environment, utilizing vision sensors and 3+1D Millimeter-wave radar. MMW radar is complementary to vision sensors, providing robust environmental information. The radar 3D point cloud is transferred to 2D radar pseudo image to unify radar and vision information format by utilizing the point transformer. We propose a multi-source object detection network (RV-YOLOX) based on radar-vision fusion for inland waterways environment. The performance is evaluated on our self-recording waterways dataset. Compared with the YOLOX network, our fusion network significantly improves detection accuracy, especially for objects with bad light conditions.

Keywords : inland waterways, YOLO, sensor fusion, self-attention

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